Seeing the Big Picture:
A Demonstration of Hand-held Technologies in Managing Project Issues on the Fly

Facility Area Network Workshop

25-26 February 2004
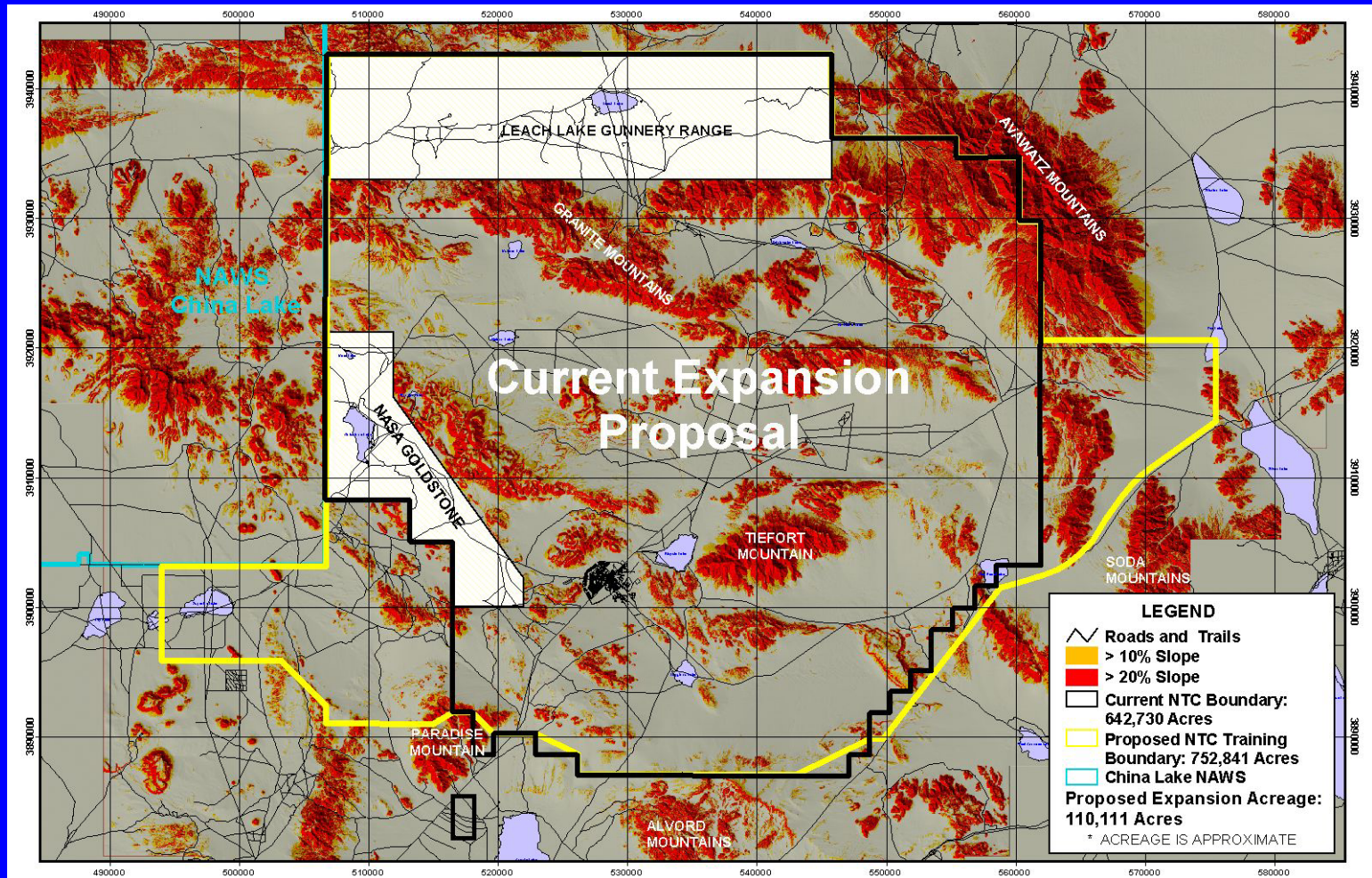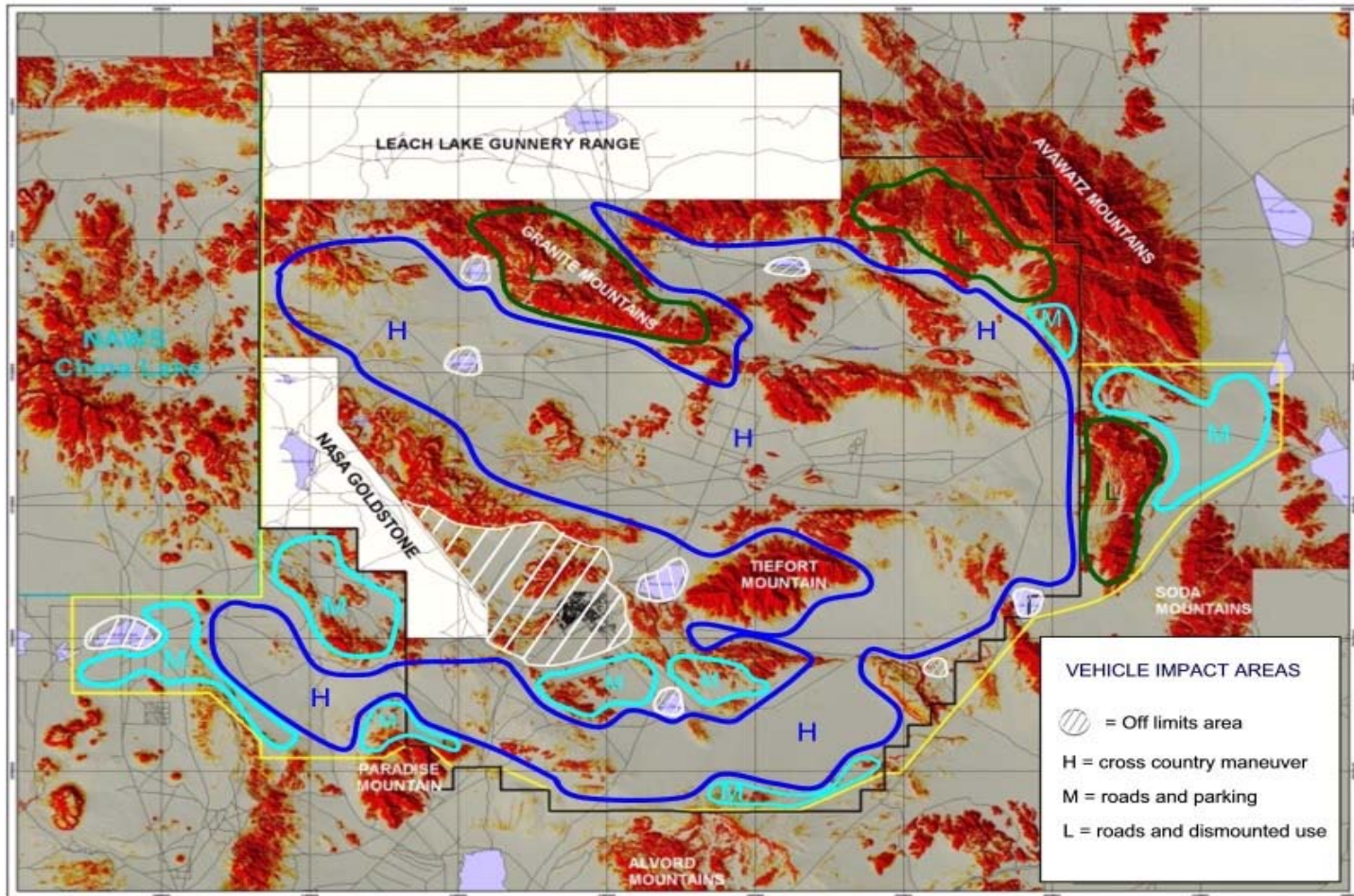
CERL-ERDC

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NTC Land Expansion

LEACH LAKE GUNNERY RANGE

AVAWATZ MOUNTAINS

GRANITE MOUNTAINS

NAWS
China Lake

Current Expansion Proposal

NASA GOLDSTONE

TIEFORT MOUNTAIN

SODA MOUNTAINS

PARADISE MOUNTAIN

ALVORD MOUNTAINS

LEGEND

- Roads and Trails
- > 10% Slope
- > 20% Slope
- Current NTC Boundary: 642,730 Acres
- Proposed NTC Training Boundary: 752,841 Acres
- China Lake NAWS

Proposed Expansion Acreage: 110,111 Acres

* ACREAGE IS APPROXIMATE

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Proposed Activities

LEACH LAKE GUNNERY RANGE

VEHICLE IMPACT AREAS

▨ = Off limits area

H = cross country maneuver

M = roads and parking

L = roads and dismounted use

Goal: To demonstrate an integrated approach to understanding, anticipating, and solving cultural resource management issues programmatically

Approach:

1) A ruggedized hand-held computer for collecting data with high-resolution digital instrumentation

2) A normalized relational database for storing and sharing the data, and

3) A GIS based archeological predictive model and management (APMM) tool for analyzing and interpreting the data

Automated Resource Management System (ARMS™)

OBJECTIVE: To research, design, develop, and validate a fully integrated client/server data collection and analysis application to enhance environmental compliance and stewardship programs

- ARMS™ may be used for all types of routine and complex natural and cultural resources investigations as well as development, sustainability, and rehabilitation efforts

- ARMS™ is a real-time tool, facilitating both short- and long-term management requirements
- (e.g. monitoring/change detection, invasive species encroachment, etc.)

- ARMS™ will facilitate data collection efforts associated with the EIS and EA process in a much more time-efficient and cost-effective manner

WHY?

- **Environmental management and land use practices are often competing for the same resources**

- **Need for georeferenced data to reconcile issues**

- **Conventional methods are costly and inefficient**
  - **Reliance on manual recordation**
  - **Training and experience of the technicians**
  - **Inconsistent data collection practices**
  - **Transcription errors**

WHY?

- **ARMS™ integrates diverse and complex geospatial and attribute data in a user friendly environment**
- **Virtual desktop in the field for decision making**
- **Cost effective**
- **Time efficient**
- **Planning tool for future studies**
  - **Captures and analyzes metrics for methodological improvements**

WHERE

- Environmental
- Safety
- Security
- Military
- Educational
- Emergency Management
- Land Use
- Urban Restoration
- Cultural Resource Management

- Fish and Wildlife
- Forestry
- Construction
- Highways
- Waterways
- Mining
- Exploration
- Manufacturing
- Recreational Management

The basic components of the ARMS™ unit:

- **A portable tablet computer as the Server and at least two ruggedized handheld PCs as the Clients**
    - **High-resolution, digital instruments (i.e., camera, global positioning system, compass, clock, and bar code labeler) to collect data**

- **ARMS™ has the ability to collect, store, and synthesize different types of data to a relational database:**
    - **GIS data**
    - **GPS data**
    - **Spreadsheet data**
    - **Form-entered user data**
    - **Other associated media (video and audio)**

ARMS™ Continued:

- **Data fusion software to interface and synchronize existing software applications**

- **Cabled, infrared, and/or digital wireless communications devices that shall:**
  - **Print bar coded labels for artifact/specimen bags**
  - **Transmit and store data for remote uploading and downloading from the client to the server**

- **Capability to interface with other modules (e.g., various remote sensing platforms, photogrammetry, soil testing instruments, etc.)**

ARMS™ Field Data Collector

1) TDS Recon Handheld PC

2) Garmin N17 GPS Receiver

3) FlyCAM 1.3 Megapixel CompactFlash Camera

4) IBM 1 Gig Micro-drive for CompactFlash

5) Intermec PB20 Direct Thermal Portable Printer

Software Recommended:
Solo Office and Solo Field (licensed per client)

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User Flexibility

- **The flexibility of the ARMS™ hardware/software configuration is that it allows the user to select the appropriate tool, or suite of tools, commensurate with the level of investigation (i.e., inventory, evaluation, mitigation) and suitable for the environmental conditions**

ARMS™ Data Processing Steps

1. upload preliminary project data, maps, aerials
2. copy project profile over to clients
3. GPS data recorded
4. field data recorded
5. artifacts recovered & bagged
6. upload field data to server
7. field checking of bags, etc.
8. post processing, consolidation, site form reporting
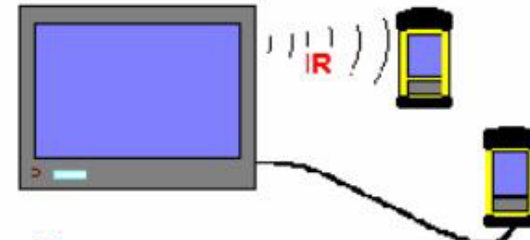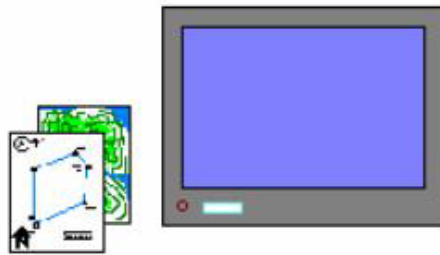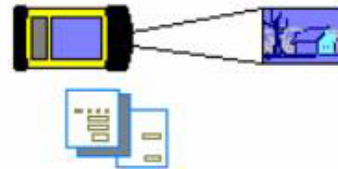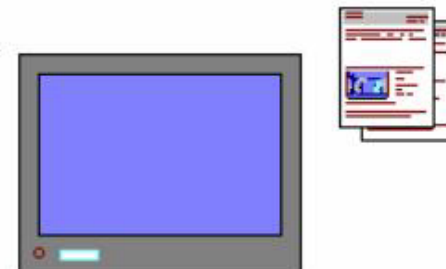
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Field Data Collection

ARMS™ in Action
(Yes! You can really see the screen)

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Features

- **A key feature of this field unit is a single pushbutton that activates a number of automated and time-saving measurements at once—a "snapshot" with a time stamp that is simultaneously applied to the entire data set**

- **Field observations and other types of data can be manually entered onto project specific, customized forms, which are pre-loaded on ARMS™, as required**

ARMS™ Main Menu

Photo recording

Record Photograph
Photo 79
Photographer: Ben
Caption: Detail of Rock Art
Get Latest Photo NE 45
PIC2004_02_03-020129-00.JPG
PIC2004_02_01-181502-00.JPG
PIC2004_02_01-181218-00.JPG
PIC2004_02_01-181202-00.JPG
PIC2004_02_01-181155-00.JPG
PIC2004_02_01-164550-00.JPG
Cancel OK
GPS HDOP: 3.0 5 of 13 Satellites 17052K
N: 2,228,348.39 m E: -1,911,596.34 m
Start 8:31 PM

Site logging

Site Summary
Name of Site 12 Ciudad del Morte
Recorder: Tad Date: 1 /27/200·
Environment ✓ Absent
Resources ✓
Constituents ✓ Methods ✓
Features ✓ Photo ✓
Date/Age ✓ Comment ✓
Cancel Log Site
100 m
18644K
Start 7:49 AM

Navigation

Navigate to 31
N: 3,904,616.13 GPS Menu
E: 516,284.507 Emulation
80 m
DGPS HDOP: 0.8 10 of 13 Satellites
Distance:
1,029,423.18 m
Bearing:
177°54'40.03" dms
Travel Dest.
Start 5:22 AM

GPS Emulation
N: 3,904,480.38
E: 516,198.014
30 m
GPS HDOP: 3.0 5 of 13 Satellites 19152K
N: 4,933,329.87 m E: 478,664.08 m
Start 5:00 AM

Area calculation

N: 6,742,573.099 m Menu
E: 699,851.450 m
Length/Area
Feature
SiteBoundary Select...
Length/Perimeter: 797.94 m
Area
3.78 hectares
37829.03 sq. m.
100 m
18336K
Start 7:57 AM

Station logging

Log This Station
Station ID: 33
Collector: Spencer
Date: 1 /27/2004
Temp: 71-80 F
Weather: Overcast
Vegetation: Desert wash scrub
Ground Vis: 26-50%
Cancel
Select
0-25%
26-50%
51-75%
76-100%
19092K
Start 7:21 AM

Logged feature review

Logged items OK
Name	ID	Last Point
Photo	1	0
Station	2	2
Station	3	3
Station	5	5
Site	6	6
SiteBoundary	7	SiteBoundary#2c
Station	8	33
Station	9	34
Station	10	35
Photo	11	10
Station	12	37
SiteBoundary	14	

Double tap on an item to view it.
Start 11:49 PM

ARMS™ Station Logging

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ARMS™ Site Logging

Photo Recording

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ARMS™ Photo Recordation

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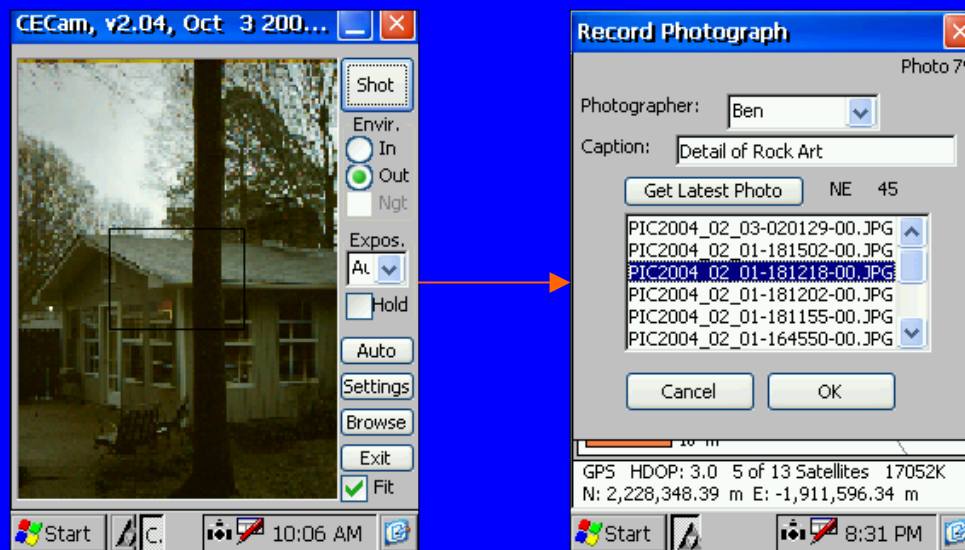
ARMS™: Other Features

Freehand Red-lining
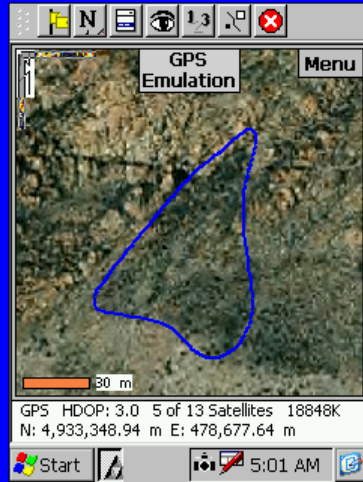
Creating Grid

Measurements

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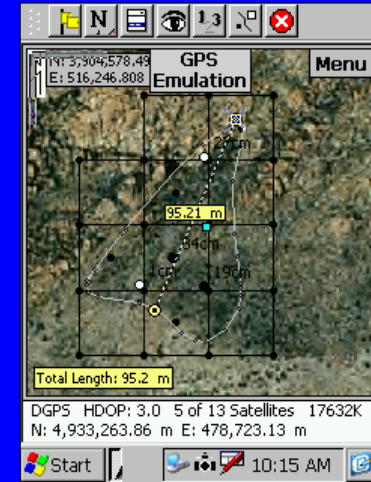
Reliability

- **Task checklist and a series of menus are generated by the software, which are displayed on the ruggedized field unit to ensure completeness, accuracy, and efficiency of the survey**

- **ARMS™ field unit has a 1Gb Flashdrive for constant data security**

- **Customized digital data forms are provided from the menus to allow the operator to easily enter standard data sets in a logical, systematic manner**

- **Finally, the raw data, reports, and photos are downloaded (in a one-step process using a wire or radio frequency connection) to the Server for reporting and further analysis using more powerful software tools**

Specific Benefits of ARMS™ as a Business Management Process

- **Technical merit: a "fail safe" approach**

- **Leveraging ability that builds on previous CERL/UIUC efforts**

- **Technology transfer to address a variety of land use and environmental management issues**

- **Cost effectiveness as demonstrated in its utility to track, monitor, and measure field data collection practices to increase efficiency**

- **Improved business process to support Installation and DoD METLs**

Conclusion

- **ARMS™ technology as a business process is Patent Pending — COE 564**

- **Will be demonstrated in March 2004 at Fort Irwin, NTC.**

- **Development cost $93K**

- **ARMS™ prototype cost $7K**